Our Work — Part 2
The Pre-Job Brief and Post-Job Review
Transcript

ANALYZE HAZARDS AND DEVELOP CONTROLS

Narrator Next, based upon the critical steps of the work, we analyze the hazards and develop controls. When we analyze the hazards, we can ask the questions…

How can we make a mistake at these points?

What is the worst thing that can happen?

What is the best thing that can happen?

When we develop and use our hazard controls, we ask questions such as:

What controls do we need, including preventative measures and bounding conditions?

What work permits are required?

How will we meet their requirements?

What are the handoffs and coordination requirements among workers and multiple PICs?

Are their hold-points and do they require sign-offs?

Mark Steve's going to be running the gun, okay. He's the PIC as far as the gun operations go today. Paulo's the PIC as far as laser operations go today.

Multiple PICS

Narrator Here, there are multiple PICS. For this shot, Mark is the overall operations PIC and remains in charge during the entire operation. For sub-tasks, Paulo is the laser operations PIC, and Steve is the gun operations PIC. Everyone understands their own and everyone else's roles in the operation.

Mark So Steve probably has some things he wants to tell you about, things that we might want to watch for and look after, and explain some of the hazards.

Primary Hazard

Narrator For this operation the primary hazards include: electrical, laser, lightning, hydrogen, high pressure, high explosives/energetic materials, and dropping heavy objects.

What follows here is a discussion of these hazards.

Steve When we fire the gun you're all going to be in the control room. It's a concrete bunker, so if anything happens out here we're going to be safe inside there.

Janice Steve, how much electrical voltage is involved?

Steve So there's like 3,500 volts that is going to go down and fire the detonator, which is going to set off the powder.

Janice Can you verify that voltage for me?

Steve Yes, it's on the fire control system. When I press the button to charge the fire control unit, I can see that voltage ramp up. And if I let go of the button — it's on a spring-loaded button — if I let go, it dumps it.

Janice So it's under your complete control the entire time.

Steve Right.

Janice Is there any way someone can come in contact with that voltage?

Steve No, we walk this building down and make sure that nobody is in this room, and all these doors are interlocked to that control unit. And I have to physically hold the button down to charge it, and so if somebody opens one of these doors, the interlock is broke and the control system dumps the power so the voltage is gone.

Janice Has an electrical safety officer reviewed this operation?

Steve Yes, he was involved from the very beginning.

Janice Okay.

Paulo And so as long as we're in the control room, the high explosives and the electrical is not going to be a problem.

Steve Mark's going to be reading the checklist, and I'm going to be repeating back to him as I check stuff off, and so is Paulo.

Stephanie Okay.

Paulo We're using two laser systems today, one is infrared at 1,550 nanometers, and the other is visible green light at 532 nanometers. Earlier today we set up all of our diagnostics and all of the light is contained in fibers and

going into the target chamber, so all the light that's on the target is all contained within a closed system. So at this point there's no laser hazards, even when we turn the lasers on. I have the key in my possession for the laser, so none of them can be powered up until I put the key into both lasers.

After the experiment is over, one of the last items on the checklist is to remove the keys from the lasers. And that prevents any laser light from being emitted from the lasers, and so this room will be clear regardless of what happens to the fibers during or after the shot.

Mark Okay, Paulo, you're PIC for the day on IWD for laser operations, so you have control of the laser key. Steve is PIC for the day on the fire operations, so he has control of the fire safe key.

So what we're going to do is we're going to go to the control room, fire a bridge wire. Then we're going to go get the propellant charge, and then as soon as we get back with the propellant charge we're going to turn red lights on, and that lets everyone know that we do have explosives in the building. Okay. A couple other hazards…like I said, we're going to operate with hydrogen today in the pump tube, but we will not pressurize until we're in the control room. And we have explosives, but those will be taken care of by other IWDs and other procedures. The only thing we might have to do is do a pause. If we get into lightning we can't transport.

Potential Pause Work

Narrator Here, as part of the IWD, the anticipation of lightning is a potential pause work.

Paulo If we do get the powder charge into the building and we get into a lightning situation, because there is a chance that we'll have lightning

today, then we're safe in this building to proceed with the experiment. What we can't do is transport the powder charge out of here. So we're safe in the building, it's lightning protected, and we're going to proceed with the shot as we normally would.

Stephanie Okay.

Mark Okay, so do we have any other concerns, Steve?

Asking Questions

Narrator It's crucial that everyone on the team feels comfortable asking questions, raising concerns, or expressing a lack of understanding. One-on-one conversations can help build comfort and involve everyone on the team. Posing a direct question to each member can promote greater participation, which is essential. So instead of asking an open question, such as "Does anyone have any questions?" — ask a direct question to each member, such as "Do you have any questions, Stephanie?" "Steve, are you comfortable with what you've heard?" Another easy practice to promote comfort and participation during discussions is to let people finish their sentences before you respond. This demonstrates respect, and each participant is heard.

Steve We should also mention that we have cameras watching the road, so before I fire this gun I'm looking for cars or trucks going by, and I'll make sure that this road is clear.

Janice Is there access control to this building?

Steve Yeah, we have access control down the road. We put the shot on the board so people know that we're going to have a shot here this day. If somebody wants to come to this building they have to check in there,

and actually the control people will tell them if they can come here or not. We've got the road posted on both sides, so when we're going to fire there's no pedestrian traffic walking by on this road. And when I fire the shot we can allow trucks and cars to go by, but when I fire the shot we have a video of the road out there, so before we press "fire" we can see that that road is clear and there's nobody out there.

Janice Okay.

Steve And also these doors are interlocked. Like we're going to red light this building and lock all these doors, and then there's interlocks on each one of these doors. So if somebody was to open a door the fire control system is going to shut down and Paulo's laser system is going to shut down. So those hazards are getting mitigated. And then we're going to have to restart again.

Mark Stephanie, do you have any more questions?

Stephanie It's my understanding that the shot takes about 15 minutes. Is this correct?

Mark Typically the shot will take about ten minutes for the actual shot sequence. So by the time Steve and I get ready to start firing the shot, me reading the checklist and him actually doing everything with the gun, it's going to be about ten minutes. It actually takes a little bit longer post-shot — right after the shot — it's going to take a few more minutes before we can actually save the gun.

Stephanie When will I be allowed to enter the room to do my testing after the experiment?

Mark Okay, Steve's the PIC for the shot, so he will answer that question.

Steve So right after the shot — what we're going to — all this hydrogen that's

in this pump tube is not going to be in that catch tank. So the first thing we're going to do is we're going to inert that catch tank with nitrogen. And so we'll inert it with nitrogen and then we'll vent that out. And then once that process is done, Mark will read the checklist. I'll get the keys to the laser and get the keys to the fire set. So I'll get the laser key from Paulo, and I already have the fire set key in my pocket. So we do that because if something happened during the shot, if a fiber broke, we'll have laser light bouncing around. So then I have those keys and I'll be able to come in this building. I'll come in, I'll walk up and down this gun and I'll make sure that everything is safe. I'll shut a couple things down, and then you can come in.

Stephanie Okay, thanks. Steve, is it safe to leave the sampling equipment in the room during the shot?

Steve Yeah, it's safe, it shouldn't be a problem.

Janice I don't see a problem from the safety standpoint. Steve, you mentioned that the doors were interlocked. Does that include the door to the control room?

Steve Yeah, that door is a steel blast door and it's interlocked too on a slider. So if that door opens then everything's going to dump. We're going to lose the laser and we're going to lose the fire set.

Janice Okay.

Steve Which is good.

Stephanie Are there any hold points for the work today?

Mark Okay, there could be several hold points. The way we have the procedure

written doesn't mean that we're not going to find something where we might have to stop and think about what we're doing or change something or stop and hold.

Steve Once we're in the firing sequence we're going to follow this checklist step by step, and we're not going to the next step unless the one before that step is checked off.

Stephanie Okay.

Steve So each one of these is actually a hold point.

Paulo I will definitely have at least one hold point when we're getting close to shooting to make sure that my diagnostics are ready to go. So I'll be doing one last check on light levels for the visar signals, and before we enter the next step, which will be very close to shooting the shot.

Stephanie Okay.

Steve One example of a pause work would be if we found a leak in the pump tube. In our procedure we fill the pump tube with helium first to check for leaks, and then if we don't have leaks then we vent the helium out and we fill it with hydrogen and we actually do the shot. But if we found a leak with the helium, we'd have to hold for just a little bit until we get the situation taken care of.

Pause Work

Narrator Here's another example of a potential pause work. If a leak appears and can be easily repaired, as stated in the IWD, then the work will continue. But if a leak appears and it's more complicated, if the leak can't be repaired, or it requires a change in material or a formal change in the IWD,

then the work will need to be paused or suspended until the IWD has been revised and approved.

Mark Okay, Janice, do you have any more questions?

Janice In the control room, is there a particular place you will need us to be?

Mark When we get to the control room I'll show you where you can sit, and we'll put you in a place where you can see everything. But we want you to be safe. Okay?

Janice Okay.

Mark Okay, Paulo, do you have any more concerns or any questions?

Paulo Yeah, actually, now that we have the interlock on the sliding door, when we do our bridge wire we're going to need to close the sliding door to turn the fire set on. Then we won't be able to hear the bridge wire. So how do we want to deal with that?

IWD – Significant Change and Informal Change

Narrator An IWD with a significant change requires a new review and approval. And according to P300, the integrated work management procedure, only three signatures are required. The responsible line manager, the person in charge, and a facilities operations director or representative. However, local requirements by your organization may vary. An informal field change, however, is without any significant changes, and it does not require a review of the whole IWD — only a review of the specific changes. This means you don't have to go through a whole new IWD approval with each informal field change.

Paulo So it's not in our procedure, but I think we need to find a solution so that we can see the bridge wire or hear the bridge wire. I think one of the things we can try to do is adjust the camera so that it's looking down at the breech for the shot and have the bridge wire in the camera view when we do the bridge wire test. And that way we can monitor from the control room when the bridge wire goes off.

Mark Yeah, we can set this up real easy, and that way we don't have to have the door open, we don't have to — we can maintain the integrity of the interlocks and keep everything safe.

Stephanie Does that pose any security concerns?

Mark No. All our cameras are allowed. We have video cameras on everything, we have video cameras on my gauges. I actually use that other camera for a gauge, and so we can watch the bridge wire and then we'll just refocus to the other gauge.

Stephanie Okay.

Paulo We can pencil it in today, then we need to get it written into the procedure as soon as we're done with the experiment.

Mark Steve, do you have any problems with that?

Steve No, we can do a field change and then make it official later.

Mark Okay.

Field Changes

Narrator Field changes can arise during any activity. Before the new interlock system was installed, they were able to hear the bridge wire. The

interlocks therefore represent both a new process and a change in process. The solution here is a good example of an informal field change. It simply involves the adaptation of existing video equipment. There are no new critical materials or new personnel. It's important that the PIC asks other team members if they agree with the informal field change and confirm that it is only a minor change, not a significant change. Any removal of a control that increases risk amounts to a significant change, and therefore requires a new review and approval of the IWD. After everyone has agreed to the importance and necessity of the field change, it is essential to document the change for future communication. Any changes will be summarized during the post-job review, and the IWD will be notated, dated, and initialed by the PIC.